

Measure 1: Transit Travel Time

Monitoring Objectives

The purpose of monitoring transit travel times is to answer the following questions regarding transit travel times in the Seattle downtown core before and after tunnel closure:

- How long are the transit travel times in the Seattle downtown core?
- How consistent are the transit travel times in the Seattle downtown core?
- Where are slowdowns occurring and are there mitigation measures that might address these slowdowns?

Methodology

Transit travel times on surface streets were measured using roadside bus detection equipment at 16 locations in the Seattle downtown core. The locations of these detection points are identified in Figure 2. A description of the equipment and technology can be found in the Methodology section of the baseline tunnel closure report.

The collection of transit travel times began in summer 2005 and will be continuously collected throughout the tunnel closure period. Two levels of data are included in the regular performance reports issued by the Monitor and Maintain Committee:

Level 1: Seattle downtown core summary statistics will be the highest level summary. They consist of aggregated travel times through the study area to define an average transit operating time in the Seattle downtown core on surface streets for the AM peak and the PM peak. This measure will show the amount of time a bus takes on average to traverse the downtown area. Considered over time, this measure will give an overall trend of the increase or decrease in delay on surface streets caused by tunnel closure.

Level 2: Transit Corridor Travel Time summary will track travel time along a discrete set of transit corridors on surface streets in the central business district. The transit corridors included in the monitoring are identified in Figure 2. The data will be categorized by corridor and by time of day (AM Peak and PM Peak). Variability of the data will also be reported to show the consistency of transit travel times.

Figure 2. Transit Travel Time Summary Analysis Corridors and Detection Point Locations



Transit Travel Time Comparison

Data for transit travel time in the Seattle downtown core post tunnel closure is collected continuously. For this report, weekday travel times between October 2, 2006 and November 21, 2006 were used. This period was used to coincide with the fall 2006 service change that went into effect Saturday, September 23rd. Time of day periods, monitoring locations and analysis tiers, as described in the previous section, are the same as the baseline report, except where noted.

In general, transit travel time averages on surface streets for this period were faster than the initial post-closure period results, and overall slightly slower than the previous report. Corridor travel times tended to be slower by approximately one minute in the northbound direction, with mixed changes in average travel time of less than one minute in the southbound direction. Overall, the tunnel closure mitigation measures continue to benefit CBD transit operations, but there are seasonal impacts that create minor variations in average transit travel times.

Seattle Downtown Core Travel Time Summary (Level 1):

The first level of analysis for downtown transit travel time is a composite measurement of average time spent in the study area. This value is obtained by identifying the first and last observation of a bus trip in the downtown core, regardless of the corridor. Averaging this figure for all trips results in a single value of time spent in the downtown core for all observed trips.

This value is used as an index, not a measure. This figure includes layover time as well as through-routed trips under one measurement. It will also include many different paths through the downtown core with different lengths and travel conditions. The measure becomes meaningful when compared to the same measurement in the future to compare the ease of travel for transit through the downtown core.

The baseline Travel Time Index is **100**, representing the value before tunnel closure. The average travel time value at that time was determined to be 21:59, based on bus trips between 4 - 6 pm on weekdays during the months of July and August, 2005. The data used for this reporting period covers the first seven weeks of the fall 2006 service change. The Travel Time index for this reporting period is **90**, based on an average travel time of 19:46, and is slower than travel time indexes of **78** and **77** reported in the Volume 3 and Volume 4 reports for the spring and summer 2006 service changes, respectively. The current index represents a **10%** decrease in time spent in the downtown core over the baseline, but a **16%** increase over the previous two reporting periods, likely due to seasonal impacts. However, the index from the comparable period for the fall 2005 service change - as reported in Volume 2 - was **111**, so this represents a significant improvement from the previous fall measurement. Travel time variability is still consistently good and also much improved over this period in 2005.

Transit Corridor Travel Time Summaries (Level 2)

The four charts in Figure 3 show the average travel times for transit after tunnel closure on selected corridors. The data was collected in October and November 2006 using the monitoring system. The data used is from weekdays only. Each chart shows the average travel time for the direction of travel and time of day indicated. The AM charts include buses observed between 7 – 9 am at the first reader on the corridor being measured. The PM charts cover the time period from 4 – 6 pm.

The average corridor travel times in this report are compared to the comparable statistics for both pre-tunnel closure baseline conditions and for the tunnel closure data reported in successive reports. Corridor travel times should not be compared to each other. Readers were placed to ensure route coverage. Readers were also sited to facilitate communications and insure access to power. As a result, the measured corridors differ in length, number of stops and number of signals, all of which affect travel time but are not related to congestion.

The reader locations that define the boundaries of each of the transit corridors are described below along with a table for each corridor that summarizes the Average Travel Time by time period along with the standard deviation (SD) of the observations in minutes. As a statistical measure, approximately 69% of all observations are within one standard deviation of the average. The SD can be interpreted as approximating the range (+/- 1SD) of the typical travel time that a majority of bus riders will experience on the corridor. There are currently four data points; Volume 1 pre-tunnel baseline, and Volume 2, 3 and 4 post-tunnel closure observations.

- Volume 1: Pre-Tunnel Closure Baseline, Third Quarter 2005
- Volume 2: Post Tunnel Closure, Fourth Quarter 2005
- Volume 3: Post Tunnel Closure, First Quarter 2006
- Volume 4: Post Tunnel Closure, Second Quarter 2006
- Volume 5: Post Tunnel Closure, Fourth Quarter 2006

Travel time summaries for all five data sets are provided in Figures 3 and 4.

Figure 3. Transit Corridor Travel Time Comparisons Before and After Tunnel Closure

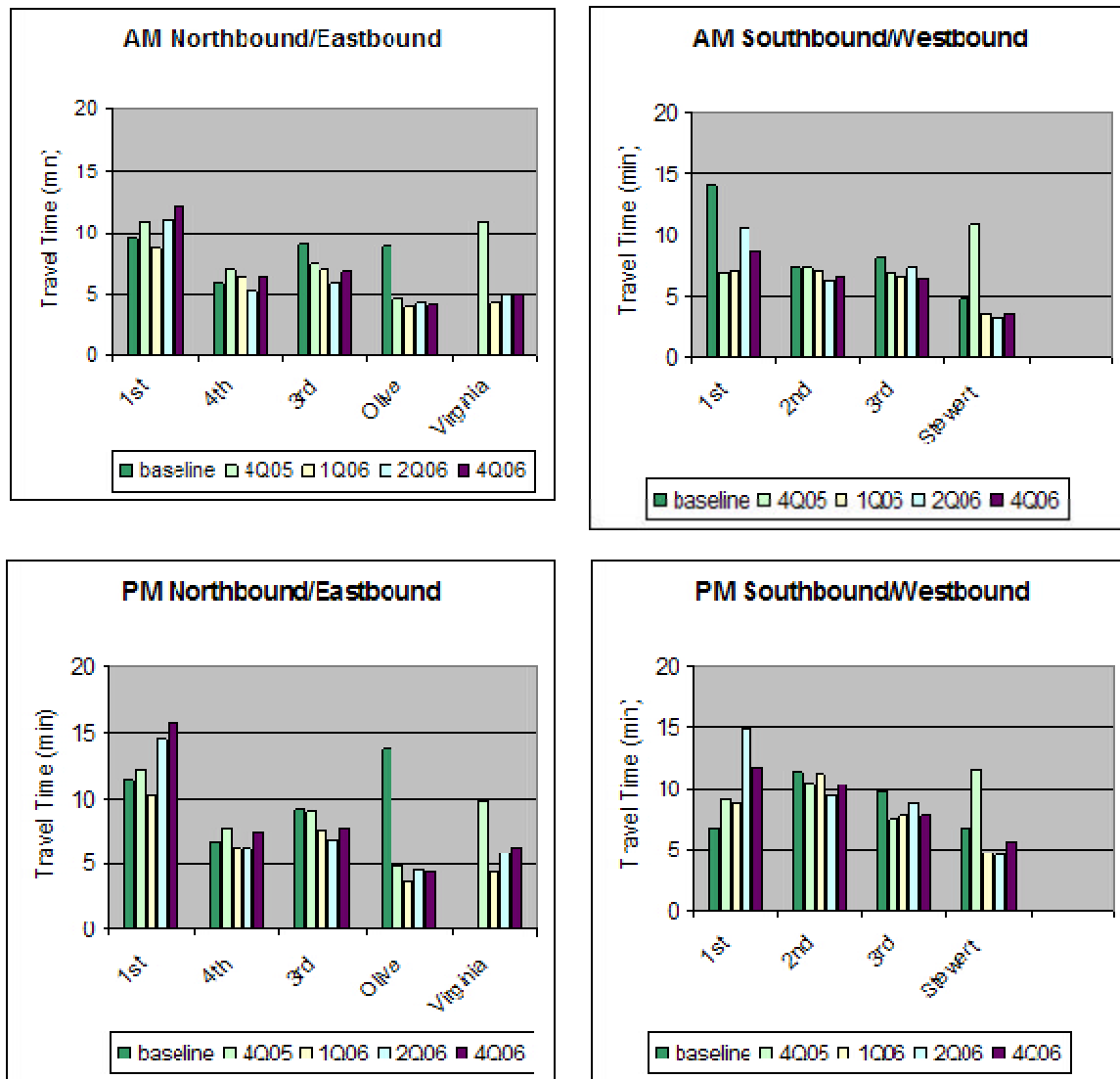


Figure 4A. First Avenue Transit Travel Time and Variation

First Avenue	AM Peak (7 – 9 am)	PM Peak (4 – 6 pm)
Northbound, Royal Brougham to Seneca Street	Travel time: Baseline – 9 min 22 sec (<i>SD: 4.8 min</i>) Volume 2 – 10 min 54 sec (<i>SD: 5.8 min</i>) Volume 3 – 8 min 36 sec (<i>SD: 1.8 min</i>) Volume 4 – 11 min 8 sec (<i>SD: 2.1 min</i>) Volume 5 – 12 min 6 sec (<i>SD: 2 min</i>) Change from Volume 4 : + 58sec	Travel Time: Baseline – 11 min 24 sec (<i>SD: 5.3 min</i>) Volume 2 – 12 min 12 sec (<i>SD: 6.0 min</i>) Volume 3 – 10 min 18 sec (<i>SD: 3 min</i>) Volume 4 – 14 min 34 sec (<i>SD: 4.3 min</i>) Volume 5 – 15 min 41 sec (<i>SD: 4 min</i>) Change from Volume 4 : +1min 7sec
Southbound, Seneca Street to Royal Brougham*	Travel time: Baseline – 14 min (<i>SD: 8.8 min</i>) Volume 2 – 7 min (<i>SD: 5.4 min</i>) Volume 3 – 7 min 8 sec (<i>SD: 1 min</i>) Volume 4 – 10 min 40 sec (<i>SD: 1.8 min</i>) Volume 5 – 8 min 39 sec (<i>SD: 1.5 min</i>) Change from Volume 4 : -2min 1sec	Travel time: Baseline – 6 min 51 sec (<i>SD: 3.9 min</i>) Volume 2 – 9 min 6 sec (<i>SD: 6 min</i>) Volume 3 – 8 min 49 sec (<i>SD: 1.4 min</i>) Volume 4 – 14 min 55 sec (<i>SD: 3 min</i>) Volume 5 – 11 min 42 sec (<i>SD: 3.1 min</i>) Change from Volume 4 : -3min 13sec

First Avenue (Northbound and Southbound) reader locations are Royal Brougham to the south and Stewart Street to the north, with a midpoint at Seneca Street. Average travel time and variation in travel time on First Avenue increased in the northbound direction and decreased in the southbound, following the overall trend for slower northbound travel this period. The relatively low number of observed trips on this corridor tends to generate greater variation from period to period than the other corridors.

Figure 4B. Second Avenue Transit Travel Time and Variation

Second Avenue	AM Peak (7 – 9 am)	PM Peak (4 – 6 pm)
Southbound, Pike Street to S Jackson Street	Travel time: Baseline – 7 min 20 sec (<i>SD: 1.9 min</i>) Volume 2 – 7 min 13 sec (<i>SD: 2.6 min</i>) Volume 3 – 7 min 11 sec (<i>SD: 1.45 min</i>) Volume 4 – 6 min 13 sec (<i>SD: 1.5 min</i>) Volume 5 – 6 min 35 sec (<i>SD: 1.4 min</i>) Change from Volume 4 : +22sec	Travel time: Baseline – 11 min 26 sec (<i>SD: 4.3 min</i>) Volume 2 – 10 min 26 sec (<i>SD: 3.5 min</i>) Volume 3 – 11 min 10 sec (<i>SD: 2.4 min</i>) Volume 4 – 9 min 22 sec (<i>SD: 2.2 min</i>) Volume 5 – 10 min 18 sec (<i>SD: 2.5 min</i>) Change from Volume 4 : +56sec

Second Avenue (Southbound only) reader locations are Pike Street and S Jackson Street with a midpoint at Seneca Street. Second Avenue increased slightly in average travel time with effectively no change in variation. Because this measurement is for the entire length of Second Avenue, it does not capture the sometimes significant delays for transit turning right at Columbia Street to access SR99 southbound.

Figure 4C. Third Avenue Transit Travel Time and Variation

Third Avenue	AM Peak (7 – 9 am)	PM Peak (4 – 6 pm)
Northbound, Yesler Way to Stewart Street	Travel time: Baseline – 9 min (SD: 4.6 min) Volume 2 – 7 min 20 sec (SD: 3.1 min) Volume 3 – 6 min 53 sec (SD: 1.3 min) Volume 4 – 5 min 53 sec (SD: 1.3 min) Volume 5 – 6 min 43 sec (SD: 1.3 min) Change from Volume 4 : +50sec	Travel Time: Baseline – 9 min 6 sec (SD: n/a) Volume 2 – 8 min 57 sec (SD: 3.6 min) Volume 3 – 7 min 41 sec (SD: 1.3 min) Volume 4 – 6 min 53 sec (SD: 1.8 min) Volume 5 – 7 min 47 sec (SD: 1.9 min) Change from Volume 4 : -48sec
Southbound, Stewart Street to Yesler Way	Travel time: Baseline – 8 min 5 sec (SD: 1.3 min) Volume 2 – 6 min 52 sec (SD: 2.8 min) Volume 3 – 6 min 36 sec (SD: 1.6 min) Volume 4 – 7 min 17 sec (SD: 1.5 min) Volume 5 – 6 min 26 sec (SD: 1.4 min) Change from Volume 4 : -51sec	Travel time: Baseline – 9 min 45 sec (SD: 2.5 min) Volume 2 – 7 min 27 sec (SD: 2.9 min) Volume 3 – 7 min 51 sec (SD: 1.5 min) Volume 4 – 8 min 46 sec (SD: 1.8 min) Volume 5 – 7 min 46 sec (SD: 1.6 min) Change from Volume 4 : -1min

Third Avenue (Northbound and Southbound) reader locations are Stewart Street to the north and Yesler Way to the south, with a midpoint at Seneca Street. Average travel times reversed the change from the previous period slowing in the northbound direction and improving in the southbound direction. Average travel times are nearly even with spring measurements from Volume 3. Variation is consistent across the most recent three measurement periods. Travel times and variation in both directions and peak periods are improved over the pre-closure conditions.

Figure 4D. Fourth Avenue Transit Travel Time and Variation

Fourth Avenue	AM Peak (7 – 9 am)	PM Peak (4 – 6 pm)
Northbound, S Jackson Street to Seneca Street	Travel time: Baseline – 5 min 48 sec (SD: 1.2 min) Volume 2 – 6 min 58 sec (SD: 2.8 min) Volume 3 – 6 min 14 sec (SD: 1.35 min) Volume 4 – 5 min 12 sec (SD: 1.2 min) Volume 5 – 6 min 16 sec (SD: 1.3 min) Change from Volume 4 : +1min 4sec	Travel Time: Baseline – 6 min 46 sec (SD: 1.1 min) Volume 2 – 7 min 50 sec (SD: 4 min) Volume 3 – 6 min 15 sec (SD: 2 min) Volume 4 – 6 min 11 sec (SD: 2.2 min) Volume 5 – 7 min 29 sec (SD: 2.8 min) Change from Volume 4 : +1min 18sec

Fourth Avenue (Northbound only) reader locations are Seneca Street to the north and S Jackson Street to the south. Average travel times increased by one minute in both the AM and PM peak. In the AM peak, travel time variation remained the same with average travel times returning to the prior spring averages. In the PM peak, travel time variation increased with average travel times.

Figure 4E. Virginia, Olive Way and Howell Transit Travel Time and Variation

	AM Peak (7 – 9 am)	PM Peak (4 – 6 pm)
Eastbound Virginia, Third Avenue to Ninth Ave	Travel time: Volume 2 – 10 min 39 sec (<i>SD: 5.1 min</i>) Volume 3 – 4 min 23 sec (<i>SD: .9 min</i>) Volume 4 – 4 min 53 sec (<i>SD: .9 min</i>) Volume 5 – 4 min 53 sec (<i>SD: 1.0 min</i>) Change from Volume 4 : none	Travel Time: Volume 2 – 9 min 50 sec (<i>SD: 4.9 min</i>) Volume 3 – 4 min 28 sec (<i>SD: 1 min</i>) Volume 4 – 5 min 48 sec (<i>SD: 2.4 min</i>) Volume 5 – 6 min 11 sec (<i>SD: 2.7 min</i>) Change from Volume 4 : +23sec
Eastbound Olive Way, Third Avenue to Eighth Ave	Travel time: Baseline – 8 min 42 sec (<i>SD: 9.1 min</i>) Volume 2 – 4 min 34 sec (<i>SD: 2.4 min</i>) Volume 3 – 3 min 54 sec (<i>SD: 1 min</i>) Volume 4 – 4 min 19 sec (<i>SD: 1 min</i>) Volume 5 – 4 min 6 sec (<i>SD: 1.1 min</i>) Change from Volume 4: -13sec	Travel Time: Baseline – 13 min 43 sec (<i>SD: 9.7 min</i>) Volume 2 – 4 min 51 sec (<i>SD: 2.5 min</i>) Volume 3 – 3 min 41 sec (<i>SD: .9 min</i>) Volume 4 – 4 min 34 sec (<i>SD: 1.45 min</i>) Volume 5 – 4 min 25 sec (<i>SD: 1.9 min</i>) Change from Volume 4 : -9sec
Eastbound Howell, Eighth Ave to Yale Street	Travel time: Baseline – 2 min 6 sec (<i>SD: 1.4 min</i>) Volume 2 – 3 min 53 sec (<i>SD: 2.4 min</i>) Volume 3 – 3 min 23 sec (<i>SD: 1.6 min</i>) Volume 4 – 3 min 3 sec (<i>SD: 1.25 min</i>) Volume 5 – 3 min 3 sec (<i>SD: 1.3 min</i>) Change from Volume 4 : none	Travel Time: Baseline – 5 min 25 sec (<i>SD: 3.1 min</i>) Volume 2 – 5 min 37 sec (<i>SD: 3.3 min</i>) Volume 3 – 4 min 50 sec (<i>SD: 2.3 min</i>) Volume 4 – 5 min 23 sec (<i>SD: 2.5 min</i>) Volume 5 – 5 min 51 sec (<i>SD: 2.6 min</i>) Change from Volume 4 : +18sec

Virginia Street (Eastbound only) reader locations are Third Avenue at Stewart to the west and Ninth Avenue at Stewart to the east. Virginia Street was not a transit routing before the tunnel closure, so there is no baseline data. Average travel times and variation were virtually unchanged from the previous report.

Olive Way (Eastbound only) reader locations are Third Avenue to the west and Eighth Avenue to the east. Average travel times and variation were virtually unchanged from the previous report.

Howell (Eastbound only): Transit on Howell east of Eighth Avenue was effectively unchanged from the previous reporting period.

Figure 4F. Stewart Street Transit Travel Time and Variation

	AM Peak (7 – 9 am)	PM Peak (4 – 6 pm)
Westbound, Ninth Avenue to Third Avenue	Travel time: Baseline – 4 min 50 sec (<i>SD: 1.9 min</i>) Volume 2 – 10 min 52 sec (<i>SD: 5.2 min</i>) Volume 3 – 3 min 31 sec (<i>SD: 1 min</i>) Volume 4 – 3 min 8 sec (<i>SD: 1.5 min</i>) Volume 5 – 3 min 32 sec (<i>SD: 1.05 min</i>) Change from Volume 3 : +24 sec	Travel Time: Baseline – 6 min 42 sec (<i>SD: 1.5 min</i>) Volume 2 – 11 min 36 sec (<i>SD: 4.9 min</i>) Volume 3 – 4 min 42 sec (<i>SD: 2 min</i>) Volume 4 – 4 min 32 sec (<i>SD: 2.5 min</i>) Volume 5 – 5 min 40 sec (<i>SD: 3.3 min</i>) Change from Volume 3 : +1min 8sec

Stewart Street (Westbound only) reader locations are Third Avenue to the west and Ninth Avenue to the east. Average travel time increased slightly in the AM and by about 1 minute in the PM Peak. More significantly, PM Peak variation increased by almost a minute to 60% of the average travel time. The current average travel times are still significantly better than the same period a year ago, as reported in Volume 2.